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New beetles (Insecta: Coleoptera) from the Late Permian of South Africa

by

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ABSTRACT

Permian beetles are represented mostly by isolated elytra. Taxa based on elytra were essentially natural during the Early and most of the Late Permian, when the process of transformation of the forewing into the elytron continued. Towards the end of the Permian, different lineages of beetles acquired similar elytra, which cannot always be used for reconstruction of the phylogenesis and description of the system. However, assemblages of elytra were demonstrated to be useful tools for illustrating stages of the development of beetle faunas in general. The comparison of successions of beetle assemblages of Sub-Angaraland, Angaraland and Gondwana showed that these successions are homotaxal, and similar stages are most probably synchronous. New beetles, *Taldycupes africanus* Ponomarenko, sp. n., *T. lidgettoniensis* Ponomarenko, sp. n. (Taldycupedidae), *Rhombocoleites danutae* Ponomarenko & Mostovski, sp. n. (Rhombocoleidae), *Paladernosyne natalensis* Ponomarenko, sp. n. (Schizocoleidae), and *Permosyne elongata* Ponomarenko, sp. n. (Permosynidae), are described from the Upper Permian Volksrust Formation of KwaZulu-Natal, South Africa.

KEY WORDS: Coleoptera, Taldycupedidae, Schizocoleidae, Rhombocoleidae, Permosynidae, beetles, Late Permian, Upper Tatarian, Volksrust Formation, Gondwana, Angaraland, new species.

INTRODUCTION

In the past, palaeontologists have devoted relatively little attention to the study of fossil insects, including beetles. However, detailed study of ancient rocks has demonstrated that fossil insects are quite common in many types of sediments. This rich material is important for the systematics and phylogeny of insects as well as for solving many problems of palaeoecology, palaeogeography and palaeoclimatology (Rasnitsyn & Quicke 2002).

Recently, detailed investigations have been undertaken of changes in animal and plant assemblages around the Permo-Triassic ecological crisis, which was followed by the greatest mass extinction on Earth. The model objects for these studies were vertebrates of southern Africa and north-eastern Europe; data showed remarkable parallellisms in development of these faunas that changed essentially synchronously (e.g. Angielczyk & Kurkin 2003; Ivakhnenko 2005, and papers cited therein). On the other hand, the Laurasian and Gondwanan floras were shown to be essentially different. Cordaites and peltasperms dominated in the Northern Hemisphere (Meyen 1970), whereas glossopterids dominated in the Southern Hemisphere (Anderson & Anderson 1985). Until recently, lack of sufficient data on insects has impeded the incorporation of this most diverse group of animals, which are closely associated with plants, into this model.

Permian insect localities are scattered spatially and temporarily, not forming successions of assemblages which are necessary for well-substantiated analysis. The only reasonably detailed succession is recorded in localities of the Kuznetsk Basin, where the insects have been thoroughly studied (Rohdendorf *et al.* 1961). However, tetrapods are unknown in the Kuznetsk basin deposits, and this makes correlation with other regions more difficult. Recently, reasonably comprehensive sequence of Late Permian insect localities has been recognised in European Russia. It is most important that these localities are fossil-rich, with vertebrates, insects, ostracods, molluscs, micro and macro plant remains being represented. This became a background for an attempt to analyse a pattern of changes in the composition of beetle assemblages and their ecology (Ponomarenko 2004). Changes of systematic composition of coleopteran assemblages in European Russia (Sub-Angaraland) and Siberia (Angaraland) have proved to be homotaxal and possibly synchronous. Beetles from the Irati Formation in Brazil are found to be the same as in the Kazanian deposits of Russia. That work was preliminary; South African beetles were examined only from photographs obtained via Internet and left formally undescribed. This unavoidably led to some errors. That is why it is so important to study Late Permian beetle remains from South Africa in detail. The present paper deals with five new species assigned to the families Taldycupedidae, Rhombocoleidae, Schizocoleidae, and Permosynidae. Some of them were previously mentioned as undescribed (van Dijk 1981; van Dijk & Geertsema 1999). In general, Palaeozoic insects of southern Africa have been reviewed by Geertsema *et al.* (2002).

Two specimens come from the locality of Lidgetton near Howick in KwaZulu-Natal. The insect-bearing deposits are referred to the Volksrust Formation, Ecca Group, and the locality has been described by van Dijk (1981). Initially, one of them was identified on the basis of a photograph as the oldest representative of Schizocoleidae. However, subsequent examination of the specimen in oblique light showed the presence of regular punctate striae on its elytra, remains of cells that existed in less advanced froms. Consequently, this specimen should be placed into the family Rhombocoleidae. Regrettably, as often occurs in complete multi-layer beetle compressions, structural details of the elytra cannot be seen, especially in the taxonomically important humeral area. Therefore, a genus of isolated rhombocoleid elytra accommodating this species cannot be identified. It can be demonstrated that it belongs to neither *Rhombocoleus* nor *Rossocoleus*, but discrimination between *Karakanocoleus* and *Erunakicupes* is impossible. There is a formal genus *Rhombocoleites*, which was erected for a beetle with partially preserved body lacking structural details of its elytra (Ponomarenko 1969). It is reasonable to place the specimen under discussion into this genus, although *Rh. danutae* sp. n. and the type species are quite different and might actually belong to different genera. The second specimen from this locality is a representative of the genus *Taldycupes* (Taldycupedidae). The family has been recorded in the second part of the Upper Permian in Siberia only and is not known from the European part of Russia.

Three specimens come from the locality of Balgowan, near Lidgetton, where the same formation is exposed. Initially, one of the specimen was identified on the basis of a photograph as a member of the family Rhombocoleidae. It is represented by an isolated elytron, which indeed resembles elytra of beetles of this family in its shape and in having large punctures in the striae. However, detailed examination of the specimen itself showed that the 'schiza' is absent and shortened striae are apparently missing from the humeral part of the elytron. Therefore, it should be considered as a representative of the family Permosynidae. The second specimen is a beetle from the genus *Taldycupes*, and the third one is a smooth elytron which can belong to the genus *Palademosyne* (Schizocoleidae).

All described specimens are housed in the collection of the Natal Museum (NMSA).

TAXONOMY

Family Taldycupedidae Rohdendorf, 1961

Genus *Taldycupes* Rohdendorf, 1961

Taldycupes africanus Ponomarenko, sp. n.

Fig. 1

Etymology: From Africa.

Description: Elytron 2.8 mm long, 0.8 mm wide. Elytron small, elongated and convex, 3.5 times as long as wide, widest just beyond its midlength, humeral part narrow. Epipleural border narrow, without cells. There are 10 rows of rounded cells on disc of elytron, with about 22 cells in one row; cells in middle part of elytron biggest. Sutural margin bordered. Scutellar row of cells short. Three veins (counted from sutural margin) ending on margin of elytron, others ending at its apex.

Holotype: NMSA, no. 2574, part and counterpart of isolated elytron. SOUTH AFRICA: *KwaZulu-Natal*: Howick, locality of Balgowan; Upper Permian, Ecca Group, Volksrust Formation.

Comparison: The new species differs from the majority of congeners in having more elongate elytra with rounded cells of different size.

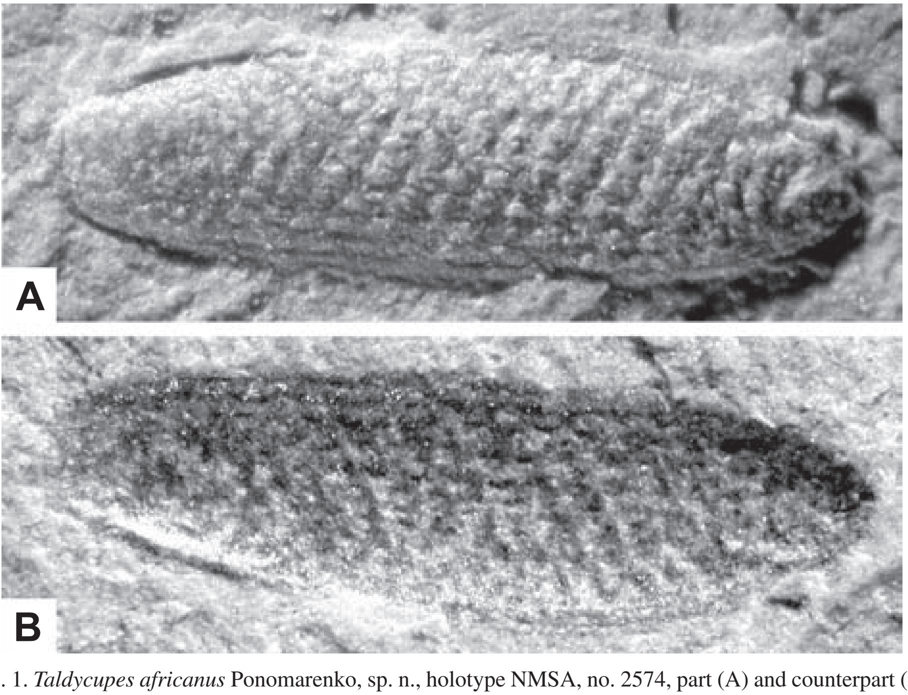


Fig. 1. *Taldycupes africanus* Ponomarenko, sp. n., holotype NMSA, no. 2574, part (A) and counterpart (B) of isolated elytron.

Taldycupes lidgettoniensis Ponomarenko, sp. n.

Fig. 2

Etymology: From the type locality.

Description: Elytron 1.9 mm long, 0.54 mm wide. Elytron small, elongated and convex, 3.5 times as long as wide, widest at its midlength, humeral part not narrow. Epipleural border narrow, without cells. There are 10 rows of rounded cells on disc of elytron, with about 25 cells in one row; cells in four rows in middle part of elytron much bigger than others. Sutural margin bordered. Scutellar row of cells short. Three veins ending on margin of elytron, others ending at its apex.

Holotype: NMSA, no. 2505, part and counterpart of isolated elytron. SOUTH AFRICA: *KwaZulu-Natal*: Howick, locality of Lidgetton; Upper Permian, Ecca Group, Volksrust Formation.

Comparison: This species is very close to *T. africanus* sp. n., but differs in being almost 0.7 times smaller than the latter species and having wider elytra with biggest cells situated closer to the sutural margin.

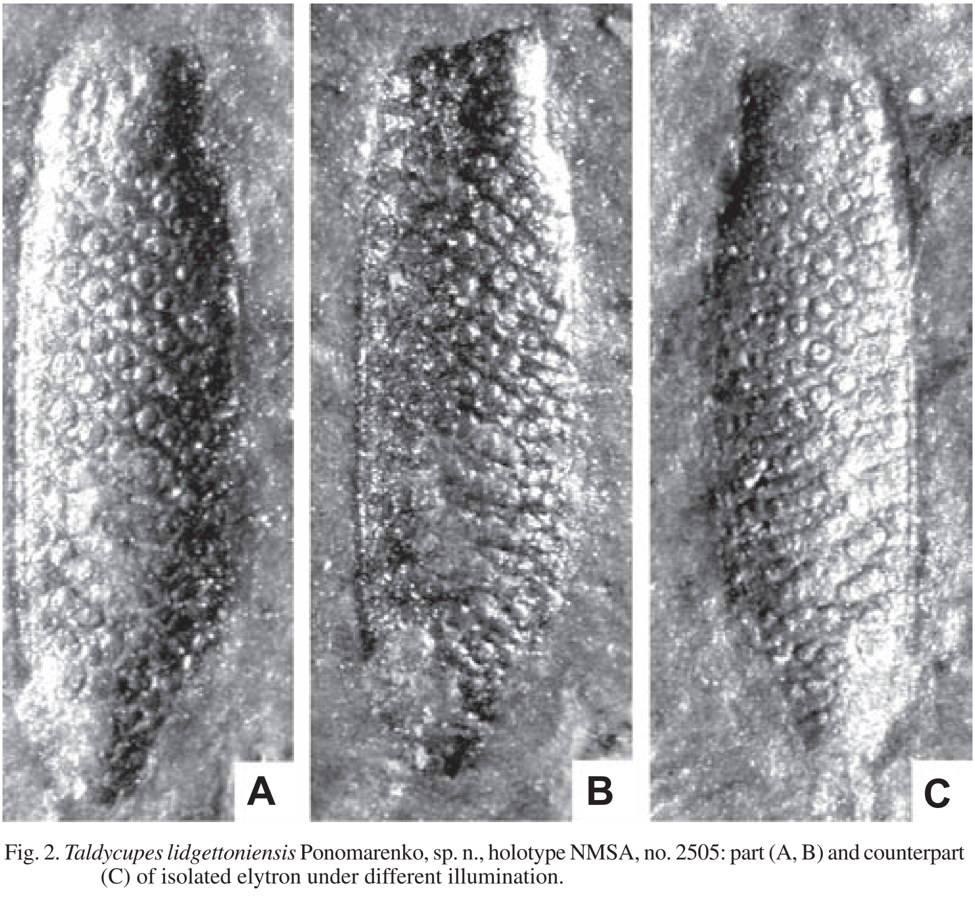


Fig. 2. *Taldycupes lidgettoniensis* Ponomarenko, sp. n., holotype NMSA, no. 2505: part (A, B) and counterpart (C) of isolated elytron under different illumination.

Family Rhombocoleidae Rohdendorf, 1961
Genus *Rhombocoleites* Ponomarenko, 1969
Rhombocoleites danutae Ponomarenko & Mostovski, sp. n.

Fig. 3

Etymology: Species named after Dr Danuta Plisko.

Description: Body over 4 mm long, elytron 3.6 mm long, 0.84 mm wide. Small oblong and flattened beetle. Pronotum slightly narrower than elytra, markedly

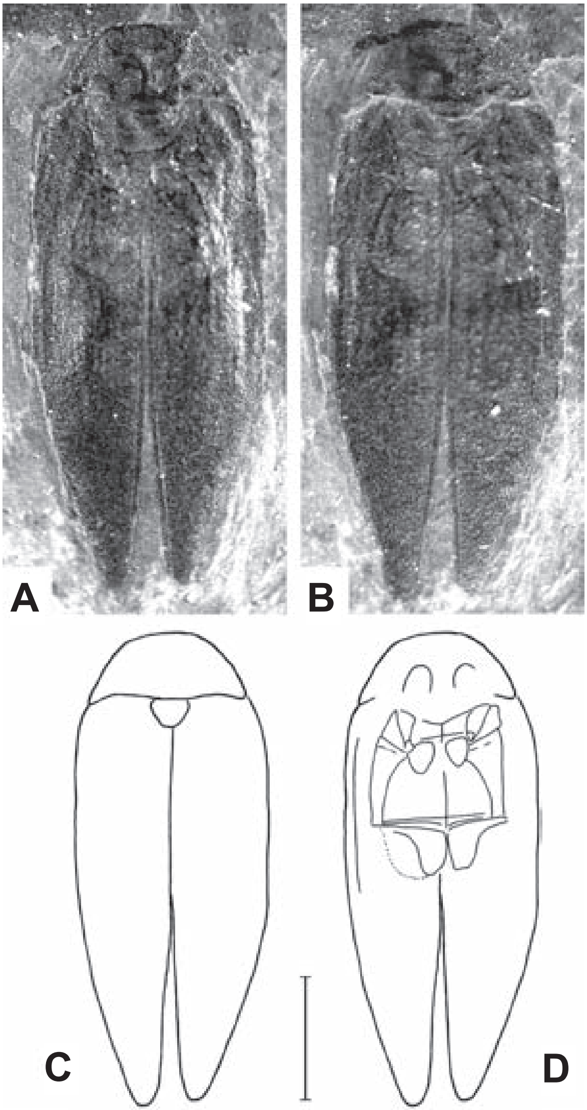


Fig. 3. *Rhombocoleites danutae* Ponomarenko & Mostovski, sp. n., holotype NMSA, no. 0999: (A, B) beetle compression under different illumination; (C, D) explanatory drawings, dorsal and ventral aspects. Scale bar = 1 mm.

narrowed anteriorly, almost 0.5 times as long as wide basally, longer than prosternum. Fore coxae large, rounded, separated. Scutellum large and triangular. Mesoventrite short, transverse, almost ribbon-like. Mesepimeres just slightly larger than mesepisternes, forming an almost regular rectangle. Mid coxae longer than wide. Metaventrite transverse, occupies most of metathorax, 0.5 times as long as wide at rear margin, with rounded lateral margins. Metepisternes reaching hind coxal pits, strongly but evenly widened anteriorly; their anterior margin 2 times as wide as their posterior margin. Hind coxae completely separating metathorax and abdomen, slightly wider than long; large coxal plates probably existed. Elytron narrow, over 4 times as long as wide, narrowing in apical 1/3. 'Schiza' long, situated opposite beginning of abdomen, sutural margin bordered, epipleural border narrow. Punctate striae visible only in sutural part of anterior half of elytron. Whole body densely covered with large tubercles, which are especially large on pronotum and thoracic ventrites.

Holotype: NMSA, no. 0999, beetle compression, head and legs missing. SOUTH AFRICA: *KwaZulu-Natal*: Howick, locality of Lidgetton; Upper Permian, Ecca Group, Volksrust Formation.

Comparison: *Rh. danutae* sp. n. differs from the other species in having a broad narrowing anteriorly pronotum, fore coxae situated closer to the rear margin of the prothorax (it cannot be observed whether the hind coxae are open or closed), almost triangular metepisternes that are closer in size to the metepimeres, shorter metaventrite, and in the metepisternes being stronger widened anteriorly.

Family Schizocoleidae Rohdendorf, 1961

Genus *Palademosyne* Rohdendorf, 1961

Palademosyne natalensis Ponomarenko, sp. n.

Fig. 4

Etymology: From the province of KwaZulu-Natal.

Description: Elytron 2.1 mm long, 0.8 mm wide. Elytron small, elongated, flattened, 2.6 times as long as wide, widest just before its mid-length, humeral part not narrow. Epipleural border not narrow. Disc of elytron smooth. Sutural margin narrowly bordered.

Holotype: NMSA, no. 2573, counterpart of isolated elytron. SOUTH AFRICA: *KwaZulu-Natal*: Howick, locality of Balgowan; Upper Permian, Ecca Group, Volksrust Formation.

Comparison: *P. natalensis* sp. n. is very close to the type species, but differs from the latter in being considerably larger, in having a wider epipleural border, and in the sutural border being shifted to the sutural margin.

Family Permosynidae Tillyard, 1924

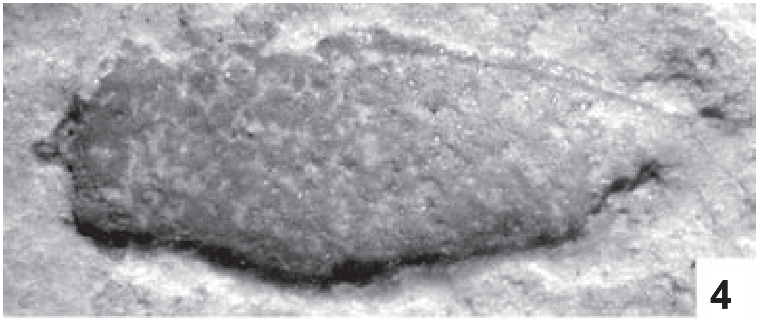
Genus *Permosyne* Tillyard, 1924

Permosyne elongata Ponomarenko, sp. n.

Fig. 5

Etymology: L. *elongata* (elongate).

Description: Elytron 3.3 mm long, 0.9 mm wide. Elytron convex, narrow, over 3.5 times as long as wide, widest around its mid-length, narrowed in apical third; its base



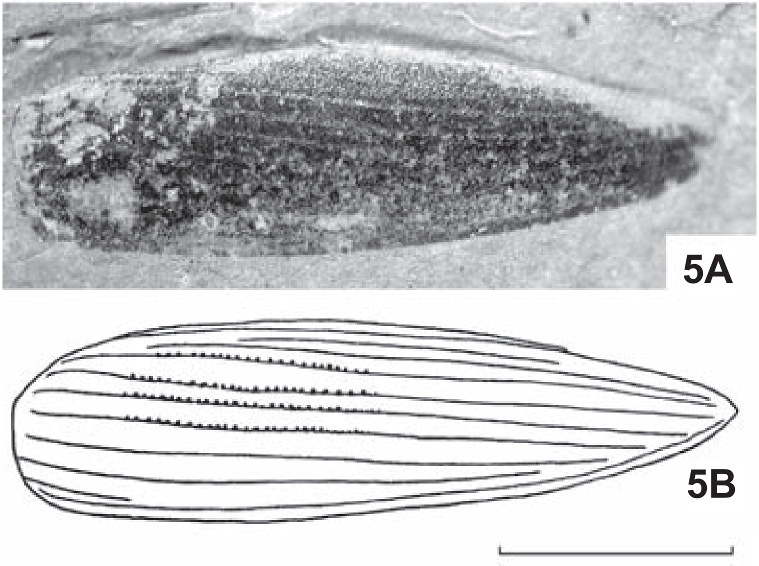


Fig. 4, 5. South African members of the families Schizocoleidae and Permosynidae: (4) *Palademosyne natalensis* Ponomarenko, sp. n., holotype NMSA, no. 2573, counterpart of isolated elytron; (5) *Permosyne elongata* Ponomarenko, sp. n., holotype NMSA, no. 2521: (A) impression of isolated elytron, (B) explanatory drawing. Scale bar = 1 mm.

narrow and apex tapered. Sutural margin convex, bordered. Epipleural border narrow. Punctate striae in basal two thirds of elytron run parallel obliquely toward sutural margin; punctures large, especially in basal half of elytron. Two last striae in adsutural part of elytron terminate at sutural margin.

Holotype: NMSA, no. 2571, impression of left elytron. SOUTH AFRICA: *KwaZulu-Natal*: Howick, locality of Balgowan; Upper Permian, Ecca Group, Volksrust Formation.

Comparison: *P. elongata* sp. n. differs from other species in having long, narrow and convex elytra with striae formed by large punctures.

DISCUSSION

All specimens found in the Volksrust Formation are tiny beetles, which is a typical of the terminal Permian. There are no representatives of Permocupedidae among them. The latter family is known only from a single monobasic genus described from the

White Hill Formation in Western Cape (Geertsema & van den Heever 1996). It is possible to conclude that permocupedids are absent from the fossil record at the Volksrust time as well as from the terminal Permian of Russia. The composition of the beetle assemblage suggests that the Volksrust Formation most probably correlates with the upper part of the Severnaya Dvina Horizon or the lower part of the Vjatka Horizon of the Upper Tatarian in the European Russia. However, the Volksrust assemblage is generally closer to the Upper Permian Siberian beetle assemblages than to the European ones.

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